

9 *South Coast Region*

California's South Coast Region encompasses more than 8 million acres, extending along the coast from the middle of Ventura County in the north to the Mexican border in the south. Inland, the region is bounded by the Peninsular mountain ranges and the transition to the Mojave and Colorado deserts on the east and by the Transverse mountain ranges on the north. It is an area of strikingly varied landscapes, ranging from wetlands and beaches to hillsides, rugged mountains, arid deserts, and densely populated metropolitan areas.



Tim Palmer

The region's coastal habitats include coastal strand, lagoons, and river-mouth **estuaries** that transition from **riparian** wetlands to fresh and saltwater marshes. California least tern, Western snowy plover, light-footed clapper rail, California brown pelican, and other waterfowl and shorebirds depend on these habitats. Moving inland, the predominant hillside and bluff communities are coastal sage scrub and chaparral. Southern California's coastal sage scrub is composed of a mix of drought-resistant shrubs and **forbs** found no place else in the country, commonly including California sagebrush, bush monkeyflower, buckwheat species, and black, purple, or white sage. Chaparral plant communities, also drought tolerant, are characterized by a greater component of woody species, including chamise, manzanita,

California lilac, and scrub oak. Inhabitants of sage scrub and chaparral communities include the coast horned lizard, rosy boa, California gnatcatcher, San Diego cactus wren, and Quino checkerspot butterfly. Isolated grasslands and **vernal pool** habitats are interspersed in the coastal landscape and support unique and endemic species such as Stephens' kangaroo rat and fairy shrimp species. Low- to mid-elevation uplands often feature oak woodlands, including Engelmann oak. Higher-elevation mountainous areas are dominated by coniferous forests, including Jeffrey pine, ponderosa pine, big-cone Douglas fir, and white fir, and support sensitive species such as the San Bernardino flying squirrel and long-eared and long-legged myotis bats. Along the Peninsular mountain range, coniferous forests transition to the western edge of the Colorado and Mojave desert ecosystems.

The region's largest river drainages include the Tijuana, San Diego, San Luis Rey, Santa Margarita, Santa Ana, San Gabriel, Los Angeles, Santa Clara, and Ventura rivers. Pine forests occur along high-elevation stream reaches, and mountain drainages host mountain yellow-legged frog, California red-legged frog, Santa Ana sucker, and Santa Ana speckled dace. Lower-elevation river reaches support riparian vegetation species, including cottonwood, willow, sycamore, and coast live oak, which provide habitat for such riparian bird species as the least Bell's vireo, southwestern willow flycatcher, Swainson's thrush, and yellow warbler, as well as the arroyo toad. In urbanized coastal areas, many sections of the region's river corridors are channelized with concrete.

The region is recognized as one of the world's hotspots of biological diversity and is home to a total of 476 vertebrate animal species, approximately 38 percent of all the vertebrate species found in California. It is also distinguished by the tremendous population growth and urbanization that have transformed the landscape since the 1940s. This intersection of biological resources and urbanization has made the South Coast the most-threatened biologically diverse area in the continental U.S. (USGS 2003). More than 150 species of vertebrate animals and 200 species of plants are either listed as protected or considered **sensitive** by wildlife agencies and conservation groups (Hunter 1999).

Despite the region's rapid growth and subsequent loss of habitat, Southern California retains some large and valuable natural lands, including the national forests, which form an interconnected system of wildlands flanking the coast's metropolitan areas. Wide-ranging species, including the mountain lion, coyote, and golden eagle, can still be found in these large habitats.

On the outskirts of Los Angeles, hiking trails traversing canyons in the Santa Monica Mountains pass through the range of the mountain lion and golden eagle. Only from the mountaintops, where the view reveals the Los Angeles metropolis spreading to the ocean, is it clear that these natural lands exist within one of the world's most urbanized regions. This juxtaposition of urban landscapes with remaining significant natural areas is one of the defining characteristics of the South Coast. The ongoing pressures of growth and urbanization require substantial and timely efforts to preserve the region's remaining wildlife diversity.

Species at Risk

The Plan development team updated vertebrate and invertebrate species information in the California Natural Diversity Database (CNDDDB) during 2004–2005. The following regional summary of numbers of wildlife species, **endemic** species, and **species at risk** is derived from the updated CNDDDB.

The South Coast's widely variable geography and diverse climate have given rise to remarkable biological diversity. There are 476 vertebrate species that inhabit the South Coast Region at some point in their life cycle, including 287 birds, 87 mammals, 52 reptiles, 16 amphibians, and 34 fish. Of the total vertebrate species that inhabit this region, 82 bird **taxa**, 40 mammalian taxa, 19 reptilian taxa, eight amphibian taxa, and nine fish taxa are included on the Special Animals List. Of these, 14 are endemic to the South Coast Region, and 14 other species found here are endemic to California but not restricted to this region (Table 9.1).

Table 9.1: State-Endemic Special Status Vertebrates of the South Coast Region

<i>Ambystoma californiense</i>	California tiger salamander
<i>Anniella pulchra pulchra</i>	Silvery legless lizard
* <i>Batrachoseps gabrieli</i>	San Gabriel slender salamander
<i>Catostomus santaanae</i>	Santa Ana sucker
<i>Charina umbratica</i>	Southern rubber boa
<i>Diadophis punctatus modestus</i>	San Bernardino ringneck snake
* <i>Dipodomys merriami parvus</i>	San Bernardino kangaroo rat
* <i>Dipodomys stephensi</i>	Stephens' kangaroo rat
<i>Eucyclogobius newberryi</i>	Tidewater goby
* <i>Gasterosteus aculeatus santannae</i> (=ssp. 1)	Santa Ana (=Shay Creek) threespine stickleback
<i>Gasterosteus aculeatus williamsoni</i>	Unarmored threespine stickleback

<i>Gila orcutti</i>	Arroyo chub
* <i>Glaucomys sabrinus californicus</i>	San Bernardino flying squirrel
* <i>Lampropeltis zonata</i>	California mountain kingsnake (San Bernardino population)
<i>Lampropeltis zonata</i>	California mountain kingsnake (San Diego population)
* <i>Microtus californicus stephensi</i>	South Coast marsh vole
* <i>Myotis lucifugus</i>	Little brown bat (San Bernardino Mountains population)
<i>Ovis canadensis nelsoni dps**</i>	Peninsular bighorn sheep
* <i>Perognathus alticolus alticolus</i>	White-eared pocket mouse
<i>Perognathus alticolus inexpectatus</i>	Tehachapi pocket mouse
* <i>Perognathus longimembris brevinasus</i>	Los Angeles pocket mouse
* <i>Rhinichthys osculus ssp. 3</i>	Santa Ana speckled dace
* <i>Sorex ornatus salicornicus</i>	Southern California saltmarsh shrew
* <i>Spermophilus lateralis bernardinus</i>	San Bernardino ground squirrel
<i>Spermophilus tereticaudus chlorus</i>	Palm Springs round-tailed ground squirrel
<i>Tamias speciosus speciosus</i>	Lodgepole chipmunk
<i>Taricha torosa torosa</i>	Coast Range newt
* <i>Thamnophis sirtalis ssp.</i>	South Coast garter snake

* denotes taxon is endemic to region

** dps=distinct population segment

The number of arthropod species is so great, and they are so poorly known taxonomically, that it is presently impossible to accurately estimate the total number of invertebrate species occurring in the state. In the South Coast Region, however, 43 invertebrate taxa are included on the Special Animals List, including 38 arthropod taxa and five mollusk taxa. Of these, 29 are endemic to the South Coast Region, and nine other taxa found here are endemic to California but not restricted to this region (Table 9.2).

Table 9.2: State-Endemic Special Status Invertebrates
of the South Coast Region

* <i>Branchinecta sandiegonensis</i>	San Diego fairy shrimp
* <i>Brennania belkini</i>	Belkin's dune tabanid fly
<i>Calileptoneta oasa</i>	A leptonetid spider; no common name
* <i>Carolella busckana</i>	Busck's gallmoth
<i>Ceratochrysis longimala</i>	A chrysidid wasp; no common name
* <i>Cicindela gabbii</i>	Gabb's tiger beetle
<i>Cicindela hirticollis gravida</i>	Sandy beach tiger beetle

* <i>Cicindela latesignata latesignata</i>	A tiger beetle; no common name
* <i>Cicindela senilis frosti</i>	A tiger beetle; no common name
* <i>Cicindela tranquebarica viridissima</i>	Greenest tiger beetle
<i>Coelus globosus</i>	Globose dune beetle
* <i>Euchloe hyantis andrewsi</i>	Andrew's marble butterfly
* <i>Eucosma hennei</i>	Henne's eucosman moth
* <i>Euphilotes battoides allyni</i>	El Segundo blue butterfly
* <i>Glaucopsyche lygdamus palosverdesensis</i>	Palos Verdes blue butterfly
* <i>Halictus harmonius</i>	Harmonius halictid bee
* <i>Helminthoglypta milleri</i>	Miller's shoulderband
<i>Helminthoglypta taylori</i>	Westfork shoulderband
* <i>Helminthoglypta traski coelata</i>	Peninsular range shoulderband
* <i>Hydroporus simplex</i>	Simple hydroporus diving beetle
* <i>Incisalia mossii hidakupa</i>	San Gabriel Mountains elfin butterfly
* <i>Linderiella santarosae</i>	Santa Rosa Plateau fairy shrimp
<i>Macrobaenetes valgum</i>	Coachella giant sand treader cricket
* <i>Mitoura thornei</i>	Thorne's hairstreak
* <i>Neduba longipennis</i>	Santa Monica shieldback katydid
* <i>Onychobaris langei</i>	Lange's El Segundo dune weevil
* <i>Panoquina errans</i>	Wandering (=saltmarsh) skipper
* <i>Plebejus saepiolus aureolus</i>	San Gabriel Mountains blue butterfly
<i>Psychomastax deserticola</i>	Desert monkey grasshopper
* <i>Pyrgus ruralis lagunae</i>	Laguna Mountains skipper
* <i>Rhaphiomidas terminatus abdominalis</i>	Delhi sands flower-loving fly
* <i>Rothelix warnerfontis</i>	Warner Springs shoulderband
* <i>Socalchemmis gertschi</i>	Gertsch's socalchemmis spider
* <i>Socalchemmis icenoglei</i>	Icenogle's socalchemmis spider
<i>Stenopelmatus cahuiensis</i>	Coachella Valley Jerusalem cricket
* <i>Trigonoscuta dorothea dorothea</i>	Dorothy's El Segundo dune weevil
* <i>Trimerotropis occidentalis</i>	Santa Monica grasshopper
<i>Tryonia imitator</i>	Mimic tryonia (=California brackishwater snail)

* denotes taxon is endemic to region

The Wildlife Species Matrix, including data on listing status, habitat association, and population trend for each vertebrate and invertebrate species included on the Special Animals List, is available on the Web at http://www.dfg.ca.gov/habitats/wdp/matrix_search.asp. For vertebrates, the matrix also includes links to species-level range maps. Additionally, a link to the California Department of Fish and Game's online Field Survey Form is available to assist

in reporting positive sightings of species on the Special Animals List to the California Natural Diversity Database (CNDDDB).

Two Species at Risk

Note: *The following discussion of two species at risk illustrates how stressors or threats affect species and highlights conservation challenges and opportunities. These species discussions are not intended to imply that conservation should have a single-species approach.*

The threats facing the Quino checkerspot butterfly and the light-footed clapper rail illustrate some of the region's most important conservation issues. Urbanization has transformed a large portion of the South Coast's landscape, and species that were once common and widespread now remain only on remnants of their former range. The Quino checkerspot butterfly illustrates this trend and demonstrates the importance of habitat connectivity in maintaining resilient wildlife populations. Regional growth also affects species that depend on unique, narrowly distributed habitat types. Urbanization can severely reduce already-limited habitat areas. The light-footed clapper rail, for example, relies on coastal salt marsh habitats and has been notably affected by coastal development.

Quino Checkerspot Butterfly



Until the 1950s, the Quino checkerspot butterfly was abundant in southern California (USFWS 2003b). Its historic range included coastal areas from Los Angeles County south into northwestern Baja California and the inland valleys south of the Tehachapi Mountains. The butterfly inhabits coastal sage scrub, open chaparral, juniper woodlands, and native grasslands and ranges from approximately 500 feet to 5,000 feet above sea level (USFWS 2003b).

Suitable habitat areas offer larval host plants, adult nectar resources, and diverse topography that includes ridges and hilltops.

The butterfly has been eliminated from more than 75 percent of its former range, including 90 percent of its coastal mesa and bluff distribution (USFWS 2003b). It is now rare even within remaining habitats, occurring at such low densities that it was once thought to be extinct. After nearly 10 years with no sightings, in the early 1990s the Quino checkerspot butterfly was rediscovered in Riverside and San Diego counties. It is presently found only in

those two counties and northwestern Baja California. The butterfly was federally listed as endangered in 1997.

In this highly urbanized region, habitat loss and fragmentation are the most significant threats to the Quino checkerspot. Remaining habitats are often degraded by recreational vehicle use, unauthorized dumping, and grazing (USFWS 2003b). These fragmented areas are also vulnerable to incursion by **invasive** species, including predatory Argentine ants, Brazilian fire ants, and Mediterranean annual grasses. A major threat to the butterfly's remaining habitat is conversion of native vegetation communities to non-native annual grasslands, a process facilitated by increased fire frequency resulting primarily from human activity (Keeley 2004).

The U.S. Fish and Wildlife Service recovery plan for the Quino checkerspot recommends immediate protection (via acquisition and easement) of remaining habitats and active management and restoration of native vegetation communities in habitats that presently support the butterfly. Landscape connectivity is very important for the stability and resilience of this species. Quino checkerspot butterfly populations naturally fluctuate sharply in response to environmental changes. In some cases, butterfly subpopulations have disappeared from protected areas when development isolated those areas from other habitat patches (USFWS 2003b). Therefore, it is critical to protect large habitat areas that are buffered from surrounding development. These areas can also support larger butterfly populations that are less likely to be quickly **extirpated** by changing environmental conditions. Protection of dispersal corridors between occupied habitat areas is also crucial for recolonization and genetic exchange (USFWS 2003b). Research needs include investigating the species' life history requirements and understanding the effects of fires on butterfly populations and host plants.

Light-footed Clapper Rail

A subspecies of clapper rail, the light-footed clapper rail inhabits coastal cordgrass-pickleweed salt marshes from Santa Barbara County to northern Baja California. Over the last two decades, survey counts of the California population have ranged from 142 breeding pairs (in 1985) to 350 (in 2004), representing one of the smallest known populations of any bird on the North American Pacific coast (CDFG 2005b). Light-footed clapper rails



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are protected as a federally listed endangered species and by the state's designation as an endangered and fully protected species.

Over the past century, the greatest threats to the light-footed clapper rail have been degradation and destruction of habitat. The majority of Southern California's coastal wetlands have been drained or filled and converted to agricultural and urban uses. No more than one-third of the habitat's historical extent remains (CDFG 2004, 2005b).

The South Coast's salt marshes are naturally relatively limited in extent and scattered along the coast, mostly at river mouths. Thus, even historically, the rails' distribution was discontinuous and restricted to limited areas. With many of these historical habitat areas eliminated or degraded, the distribution of light-footed clapper rails has become even more limited and disconnected.

Most salt marshes along the California coastline once supported clapper rails (USFWS 1985). Currently, most of the light-footed clapper rails in California occur at three sites: Upper Newport Bay Ecological Reserve in Orange County; Tijuana River Marsh National Estuarine Research Reserve in San Diego County; and Anaheim Bay in Orange County (CDFG 2005b). Sixteen other sites host the birds but have very few breeding pairs (CDFG 2004, 2005b). Remaining rail populations are isolated from each other and tend to have low dispersal rates and low genetic variability (CDFG 2004, 2005b).

Introduced predators, including feral cats, red foxes, and black rats, have also proven a substantial threat to light-footed clapper rails (USFWS 1985, CDFG 2005b). Where development encroaches on wetland habitats, predators have greater access to rail habitats, and their population numbers are higher.

The U.S. Fish and Wildlife Service 1985 recovery plan recommended enhancing and restoring marsh habitat and preserving tidal action by keeping marshes open to the sea. Minimizing human disturbance and losses to predators were also important priorities. More recently, programs to aid genetic mixing and to augment existing populations have been initiated. These include efforts to move eggs and young rails to restored marshes and a captive breeding program (CDFG 2005b).

Over the last two decades, a number of important coastal wetland sites (including Upper Newport Bay in Orange County, Goleta Slough in Santa Barbara County, and Tijuana Marsh in San Diego County) have been protected. In recent years, clapper rail numbers have shown an upward trend. In 2004, a total of 350 breeding pairs were recorded, up from 286 in 2003 (CDFG 2005b). However, birds reared in captivity have been released in California and may

have contributed to this increase. Overall, the species is believed to be responding to major habitat protection and restoration programs combined with increased predator control at key locations. Nonetheless, year-to-year fluctuations in the population and in the number of occupied marshes, along with the small total population size, demonstrate that the species remains critically endangered (CDFG 2005b). Continuing predator control, restoration, and protection of remaining coastal salt marsh habitats are needed for the survival of the light-footed clapper rail (CDFG 2005b).

Stressors Affecting Wildlife and Habitats

- Growth and development
- Water management conflicts and degradation of aquatic ecosystems
- Invasive species
- Altered fire regimes
- Recreational pressures

Growth and Development

Intensive population and development pressures have resulted in a greater number of threatened and endangered species in the South Coast region than any other location in the continental U.S. (USGS 2003). By far, the most significant stressor on the South Coast's wildlife is urban, suburban, and rural development and resulting habitat loss and fragmentation. With approximately 18.5 million residents, the area is the state's most populous region (CDOF 2004). Nearly half of California's residents live in a region that encompasses less than one-tenth of the state's land area (FRAP 1997).

Following World War II, Southern California experienced an economic and population boom spurred by military and industrial growth. The region's development patterns followed agricultural land uses and the availability of easily developed land. Across inland valleys that had supported citrus orchards and grazing, small agricultural towns grew to meet the needs of growing industry. Along the coast, development spread across the relatively flat coastal plains and mesas. Between 1940 and 2000, Los Angeles County grew from 2.79 million residents to 9.52 million, San Diego County from 289,000 to 2.81 million, and Orange County from 131,000 to 2.85 million (CDOF 2004, SCAG 2004).

Large portions of the region's natural areas have been converted to other uses; currently, nearly 40 percent the South Coast's land area is in urban and suburban use (California Legacy Project/UC Davis Information Center for the Environment 2004, CDF 2002). Beyond the im-

mediate footprint of development, urban, suburban, and rural growth patterns have fractured the landscape. Land-use planning and zoning laws have allowed sprawling development, including residential projects that are located far from existing urban centers, requiring new roads and infrastructure, along with communities designed with large lot sizes and little or no preserved open space. Presently, the region's remaining rural areas and natural lands are highly threatened by zoning for 4- to 8-acre lots for rural ranchette-style development.

As in other regions, these development patterns not only reduce the amount of habitat available but also degrade the quality of adjacent habitat. With the expansion of the urban-wildland interface, remaining natural lands become more vulnerable to the incursion of invasive plants and animals, air and water pollution, and altered **fire regimes**. Developed areas, roads, and utility corridors fragment landscapes and sever connections between habitat areas.

Water Management Conflicts and Degradation of Aquatic Ecosystems

The region's aquatic habitats—perennial and ephemeral rivers and streams, riparian areas, vernal pools, and coastal wetlands—support a diverse array of flora and fauna, including 150 animal and 52 plant species that are designated state or federal special status species (CCC 2001). Many of the South Coast's streams and rivers flow to the coast over steeply sloping terrain. These high-gradient waterways naturally carry high sediment loads and experience highly variable flows in response to rainfall. Riparian forests occur primarily along the region's waterways that travel over more gradually sloping topography. Historically, all of Southern California's rivers that flowed to the ocean supported river-mouth estuaries that transitioned from riparian areas to freshwater, brackish, and salt marshes. However, owing to the region's rugged coastal topography and narrow coastal shelf, coastal wetland systems were never as extensive as on the Atlantic or Gulf coasts.

Coastal and inland wetlands provide important wildlife habitat and serve important ecological functions, including filtering and transforming pollutants in runoff water, controlling floods, moderating sediment delivery, promoting groundwater recharge, and protecting shorelines from erosion.

Population growth and development have severely altered the region's waterways and wetlands. Flood control measures, utilization of rivers for water supply and limited hydropower development, generation of pollutants, and draining of wetlands have accompanied urbanization. Loss of historical acreage is estimated at 90 percent across all of the region's wetland types.

Vernal Pools

Vernal pools occur in small depressions underlain by impenetrable clay soils that allow water to accumulate in winter and spring wet seasons. The pools host a unique community of invertebrates and annual plants that, in turn, constitute an important part of the food web supporting amphibians and migratory waterfowl. Many sensitive plant and animal species rely on regional vernal pools, including San Diego button celery, San Diego thornmint, San Diego fairy shrimp, and Riverside fairy shrimp, each federally listed as endangered. Now reduced to less than five percent of their historical extent (USFWS 1998a), remaining vernal pool habitats in Southern California are threatened by continued conversion to urban uses, altered hydrology (due to increased runoff caused by urbanization), and off-highway vehicle activity. Much of the region's historical vernal pool habitat occurred on coastal mesas that have been largely converted to residential developments.

River Systems and Riparian Wetlands

Many of Southern California's river systems are partially or completely channelized for flood control or diverted and dammed to supply water. The South Coast has more flood-control dams (exceeding 200), more debris basins (nearly 200), and more miles of cemented stream channel than any other region in the country (CCC 2001). The Los Angeles River, for example, is lined with concrete along 47.9 miles of its 51-mile length (LACDPW 2005). Losses of riparian wetlands are estimated to be as much as 95 percent for the region (CCC 2001). Dams for flood-control and groundwater recharge, like those on the Santa Ana and San Gabriel rivers, often release water on irregular schedules, hindering the development of downstream riparian and fish communities (Swift 2005 pers. comm.). Dam releases can also contribute to **turbidity**. The operations of wastewater treatment facilities affect instream flows, and interruptions in water releases can substantially reduce flows for limited periods of time (Swift 2005 pers. comm.). Groundwater pumping, water imports from other regions, and increased runoff from impervious land cover and residential and agricultural irrigation also affect river systems. Invasive plant species—particularly arundo and tamarisk—can also alter river flows substantially. (See additional discussion in Invasive Species section.)

Sediment transport and deposition by waterways is a natural process and can create important habitat features for some species. For example, arroyo toad breeding sites are created when floods deposit sediments as sandbars. However, where human activities have fragmented **watershed** and changed natural sediment dynamics and flow regimes, sedimen-

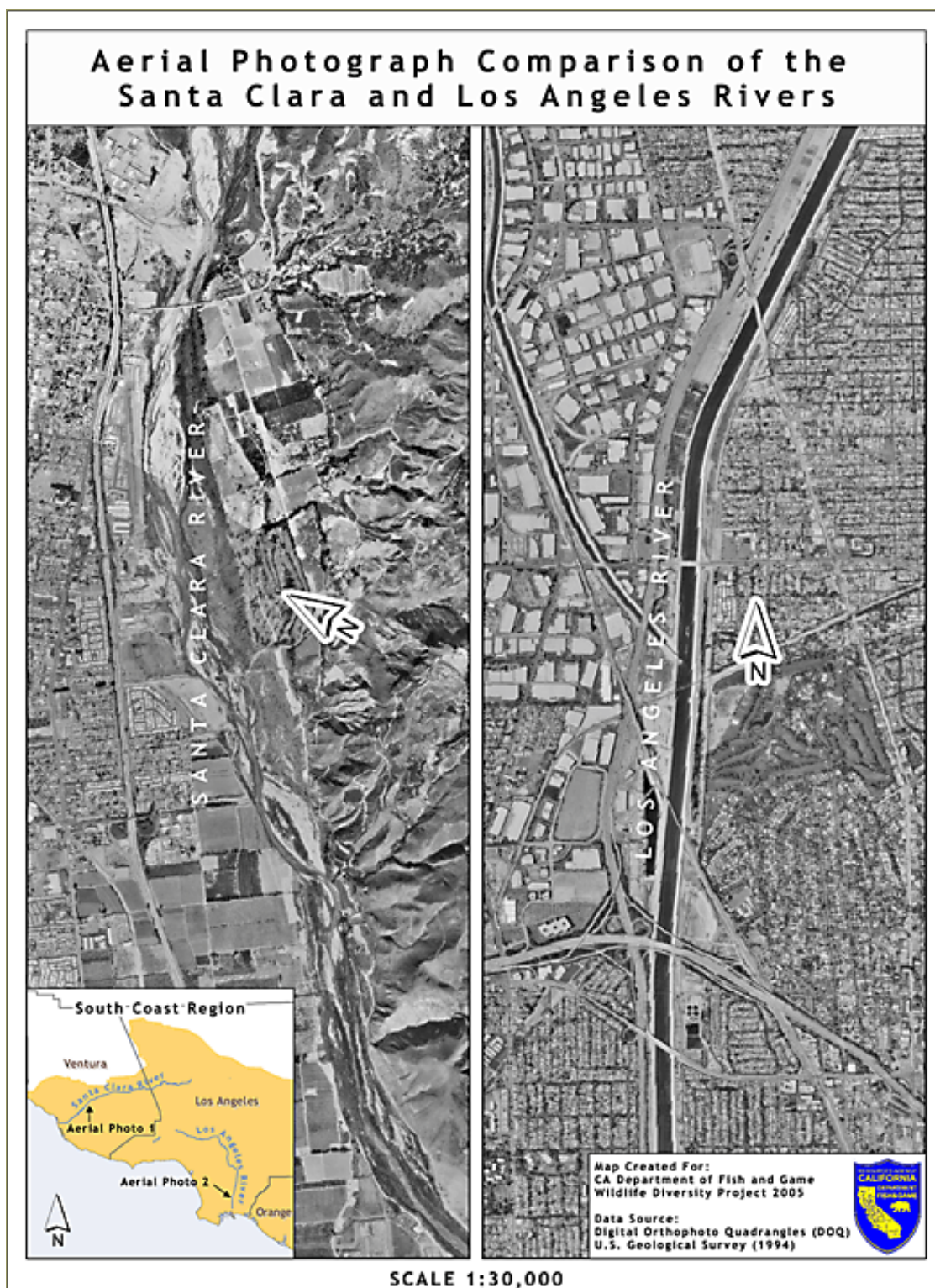


Fig. 9.1: Aerial Photograph Comparison of the Santa Clara and Los Angeles Rivers

The Los Angeles River has been channelized along most of its length, while the Santa Clara River remains free-flowing and retains its natural channel structure. Channelized rivers lose important habitat features such as braided-channel structure, backwater areas, and variable depth and flow.

tation events can be devastating for aquatic habitats and species. Intensive recreational uses, ground disturbance due to development, and wildfires can increase erosion and sediment deposition. Dams can also accumulate and release flushes of sediment. Fine sediments and silt cover natural creekbed substrates and fill in deep pools, degrading important habitats for native fish and invertebrates. Historically, greater connectivity between watersheds allowed species to recolonize after sedimentation events. Today, however, roads and water diversions have fragmented and isolated stream systems, making it difficult for species to recolonize areas where they have been locally extirpated.

Hydrologically, many of the region's rivers scarcely resemble their natural state, due to alterations of the quantity and timing of surface water flows, sediment transport functions, and flood regimes (CCC 2001). Water pollution is also a serious issue for the region's rivers, with water quality degraded by urban runoff, wastewater treatment plants, and industrial effluents.

Southern California's river and riparian habitats are important to a number of sensitive species, including least Bell's vireo (both federally and state listed as endangered), California red-legged frog (federally listed as threatened and a state species of special concern), Southern California mountain yellow-legged frog and arroyo toad (each federally listed as endangered and a state species of special concern), and southern steelhead (federally listed as threatened and a state species of concern). Steelhead illustrate the severity of the situation, having declined from historical populations in the tens of thousands to current numbers of between 200 and 300 fish (CCC 2001, Larson 2005 pers. comm.).

Coastal Wetlands

Southern California's coastal wetlands are among the most productive habitats on the Pacific Coast, providing feeding and nesting habitat for birds on the Pacific flyway and important nursery habitats for oceanic and estuarine fish. More than 60 species of fish and at least 195 species of birds have been recorded in Southern California wetlands (CCC 2001). Habitats range from salt marshes with associated tidal channels and mudflats to river mouth estuaries, canyon mouth estuaries, bays, and lagoons. The U.S. Fish and Wildlife Service nominated the coastal wetlands between Point Mugu in Ventura County to the Tijuana estuary as wetlands of international significance under the **Ramsar Convention** because of their importance for migratory birds, fisheries, and endangered species.

Estimates of total historical coastal wetland acreage range from 44,000 acres up to 55,000 acres. Today, only about 13,000 acres remain (CCC 2001). During the second half of the 19th

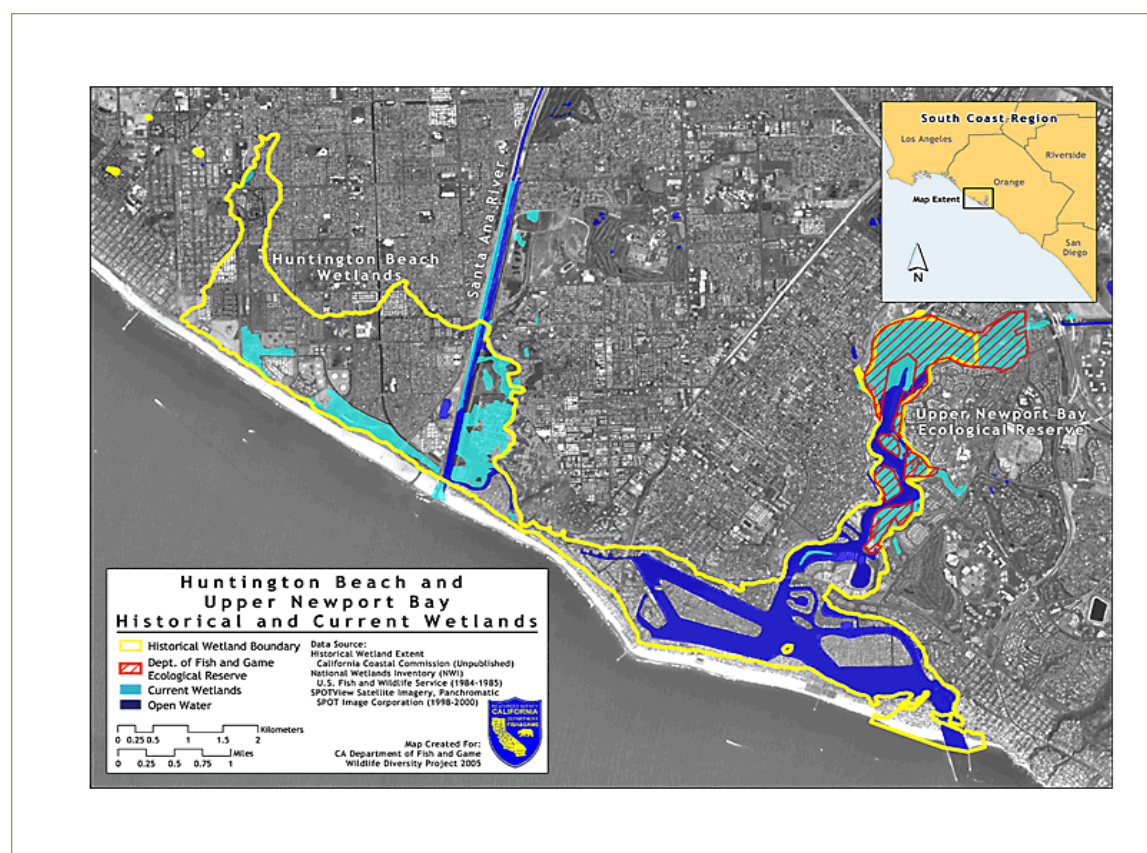


Fig. 9.2: Urban and Protected Lands Along Coast

The majority of the South Coast's coastal wetlands have been drained and filled for urban land uses. A comparison of the historic and current extent of wetlands at Huntington Beach and Upper Newport Bay illustrates this pattern.

century, federal, state, and local policies encouraged conversion of wetlands to agricultural and urban uses by draining and filling them. Urban development has replaced or degraded many coastal habitats, with urban and suburban land uses currently occurring along more than 70 percent of the coastline (CDF 2002, California Legacy Project 2004). Most remaining regional wetlands have been severely degraded by activities such as dumping, oil extraction, and creation of ponds for salt extraction and sewage treatment. Agricultural and urban runoff, wastewater treatment plants, and industrial effluents are significant pollution sources. Activities affecting the streams and rivers that feed coastal wetlands, including water diversion, flood control, and development, also degrade the wetlands. As described above, natural sediment transport processes have been altered, resulting in both sediment depletion and excessive sedimentation in coastal habitats. Dams can block sediment transport and result in depletion of coastal beach and dune areas. Construction activities that result in erosion upstream can cause excess sediment to fill in wetlands and cut off tidal flows. In the Tijuana

estuary, for example, altered sedimentation regimes are believed to facilitate the establishment of non-native tamarisk, with negative effects on habitat quality for endangered bird species (Morrison 2005 pers. comm.).

The loss and degradation of Southern California's coastal wetland habitat have left many species struggling to survive, including the tidewater goby (federally listed as endangered), Belding's Savannah sparrow (state listed as endangered), light-footed clapper rail (federally and state listed as endangered), California brown pelican (federally and state listed as endangered), and California least tern (federally and state listed as endangered).

Invasive Species

As in other regions across the state, invasive species problems on the South Coast are tied to regional land use and management issues.

In terrestrial ecosystems, a number of highly aggressive non-native plant species invade grasslands and scrub, including yellow starthistle, artichoke thistle, medusahead, Pampas grass, fennel, pepper weed, black mustard, and castor bean. These species lower habitat quality for sensitive wildlife species such as the Quino checkerspot butterfly and the California gnatcatcher. Some of these species dry out earlier in the summer than native species and contribute to increased wildfire frequencies. Access roads and rights-of-way for infrastructure and powerline maintenance, as well as recreational use of natural areas, can facilitate the spread of these species.

Among terrestrial animals, Argentine ants pose a significant regional threat. Favoring irrigated areas and edge habitats, such as irrigated golf courses and residential neighborhoods, Argentine ants tend to outcompete and displace native ants in the region's fragmented landscapes, disrupting larger community food-web relationships. For example, the coast horned lizard (a state species of concern), whose major prey is native harvester ants, cannot sustain itself on a diet of Argentine ants and so can be driven locally extinct in fragmented habitat patches.

Nest parasitism by brown-headed cowbirds also threatens many of the region's sensitive bird species, including least Bell's vireo, southwestern willow flycatcher, and California gnatcatcher. Cowbirds thrive in many human-altered habitats, including suburban areas and agricultural and grazing lands, where they are attracted to livestock droppings and feed. With the expansion of these land uses over the last century, cowbirds have thrived, greatly expanding both their range and population across California. Other problems are caused

by introduced red fox, feral animals, and pets, which prey upon native wildlife, particularly ground-nesting birds.

The European starling, introduced from Europe and now widespread in the region and in most human-modified habitats across much the state, aggressively competes with native woodpeckers, bluebirds, and other native song birds for cavity nest sites.

In aquatic systems, the most problematic exotic plant species is arundo, or giant reed. Arundo is widespread along major coastal river basins, particularly the Ventura, Santa Clara, Santa Ana, Santa Margarita, San Luis Rey and San Diego rivers. Tamarisk is less widespread but also invades regional riparian habitats. Tamarisk is distributed in coastal and desert drainages (Stephenson and Calcarone 1999). Both species choke waterways, increase flash flood risks, crowd out native plants, and provide inferior habitat for riparian species. Tamarisk also consumes prodigious amounts of water, reducing available surface water, and arundo provides limited shade, resulting in higher water temperatures and lower dissolved oxygen levels.

Among exotic wildlife species, bullfrogs, African clawed frogs, non-native crayfish, mosquito fish (which are sometimes introduced for mosquito control), and introduced sport and bait fish (including sunfish, bass, and bluegill) all pose predatory or competitive threats to native fish and amphibians. Many of these species are well adapted to the deep water conditions in ponded areas above dams, and dam releases can introduce them to downstream habitats. Most voracious and widespread are bullfrogs, which are documented predators of California red-legged frogs, arroyo toads, Western pond turtles, and two-striped garter snakes (Stephenson and Calcarone 1999). A broad diet and an extended breeding season give bullfrogs a competitive advantage over native amphibians. Bullfrogs are also favored by human-modified habitats. They can tolerate elevated water temperatures and, unlike native amphibians, make use of standing pools resulting from urban runoff to complete their two-year life cycle.

Altered Fire Regimes

Wildfire is a natural and important ecological process in the South Coast. Widespread forest management practices, as well as increases in human-caused wildfires, have altered fire regimes, in some cases causing dramatic changes in regional habitats. Efforts to establish fire regimes that approximate historical fire patterns and frequencies while also minimizing loss of property and life are important to maintain and restore wildlife habitat.

Dry conditions and annual hot, dry Santa Ana winds make all of the region's ecosystems fire-prone. Between 1999 and 2003, the South Coast experienced a four-year drought that left these ecosystems especially dry and vulnerable to fire. Furthermore, the expansion of residential development into rural and natural areas has increased the incidence of human-caused fire. In the 1990s and early 2000s, extensive wildfires affected the entire region, and costs from property loss and fire suppression have risen into billions of dollars annually. In 2003, almost 400,000 acres burned, costing more than \$1.2 billion for fire suppression efforts and to repair damages resulting from the fires (CDF 2004).

The causes and ecological consequences of wildfires differ among the region's ecological communities. In sage scrub, chaparral, and grassland systems, lightning-induced fires are fairly infrequent. Human-caused fires, however, have resulted in unnaturally high fire frequencies, especially along roads and near the urban-wildland interface, with some locations experiencing three fires within a period of 15 to 20 years (Spencer 2004 pers. comm.). Increased fire frequencies favor the Mediterranean grasses that were introduced to the region with the arrival of European settlers and livestock. Once established, the non-native grasses grow in a dense-thatch pattern that chokes out native vegetation and lowers habitat quality for wildlife. The dense grass also provides ample fuel for the cycle of frequent burning (Keeley 2004).

Attempts at fire prevention have not stopped the region's scrub and chaparral lands from burning, and it is the rate of human-caused fire and the Santa Ana wind conditions, rather than fuel build-up, that determines the extent and frequency of wildfire in these systems (Halsey 2004, Keeley 2001). Although frequent fires can promote the spread of non-native grasses, fire's effects on grassland and shrubland ecosystems depend on the time of year the fire occurs. Prescribed burning can be an effective management tool, with spring fires helping to control invasive exotics if they occur before exotic plants set seed.

Fire management issues in forest communities are different than those in scrub, chaparral, and grasslands. Lightning-induced wildfires are a more regular part of the ecology of the South Coast's coniferous forests and oak woodlands and do not result in the same threat of conversion to non-native grasslands. In some forest communities, fire suppression and other forest management practices—including livestock grazing and historical logging practices—have led to dense, even-aged forest stands, fuels buildup, and other changes to forest structure and composition (Baker and Shinneman 2004, Kaufmann 2004). In some forests, the density of white fir and incense cedar has increased at the expense of live and black oaks, which are

very important to many wildlife species, including acorn woodpecker, band-tailed pigeon, black bear, and dusky-footed woodrat (Loe 2004 pers. comm.). Western pine bark beetle infestations have killed 50 percent of the coniferous trees in the region's drought-stressed forests, making forests more fire-prone (Loe 2004 pers. comm.). The relative importance of these various factors in shaping fire patterns in the region's forests is uncertain.

Climate is also a primary determinant of fire patterns (Halsey 2004). In light of this, climate change will add a significant variable to efforts to understand historical fire regimes and to find management measures that can maintain the region's mosaic of habitats (Grissino-Mayer and Swetnam 2000). Additionally, the expansion of residential communities into fire-dependent forest ecosystems creates a conflict between maintaining forests' ecological integrity and protecting property.

Recreational Pressures

With nearly 20 million people living within driving distance of the region's national forests and other public lands, recreational access and its subsequent effects are a major concern. Recreational off-road vehicle use can have adverse effects on natural communities and sensitive species. On public lands, off-road vehicle trails open relatively undisturbed areas to increased use. The vehicles can disturb or run over wildlife, crush and uproot plants, spread seeds of invasive plants, and disturb soils, contributing to erosion and sedimentation of aquatic habitats (Hall 1980). Off-road vehicle use also increases the risk of human-caused fires.

Concentrated recreational use of streams and riparian areas is particularly troublesome. Not only off-road vehicles but hikers, picnickers, and equestrians in large numbers can damage these systems, reducing vegetative cover and disturbing sensitive species. Some recreational users build rock dams on streams to create ponds for swimming. The San Gabriel River, for example, has been altered by extensive ponded areas, as well as other effects of heavy recreational use, such as the deposition of trash and human waste (Ally 2001, Miller 2005 pers. comm.). Particularly vulnerable riparian species include the two-striped garter snake, mountain yellow-legged frog, and arroyo toad (Stephenson and Calcarone 1999). The mountain yellow-legged frog, which once lived in more than 50 of the national forests' creeks, is now limited to a handful of those creeks, and biologists have documented trampling of their egg masses by hikers (Stephenson and Calcarone 1999).

Conservation Actions to Restore and Conserve Wildlife

In addition to the recommended regional actions described below, see the recommended statewide conservation actions as given in Chapter 4.

- a. Wildlife agencies and local governments should work to improve the development and implementation of regional Natural Community Conservation Plans (NCCPs), which is the primary process to conserve habitat and species in the region's rapidly urbanizing areas.**

See discussion of Southern California NCCP at the end of this chapter and the conservation planning section in Chapter 6.

The U.S. Fish and Wildlife Service and Fish and Game need additional conservation planning staff and additional funds to ensure the intended implementation of NCCPs and to meet their obligations under the plans. Wildlife agencies must help carry out the management and monitoring of preserve system lands and ensure that local partners are carrying out their responsibilities.

For local governments currently working on NCCPs, or in areas where new NCCPs are being developed, the state could facilitate local governments' participation in the planning process by providing educational materials, leadership training, and collaborative group forums to educate local leaders about conservation planning.

Plans that are still under development should include guidelines directing federal, state, and local agencies to coordinate management and monitoring on public reserve lands, regardless of the lands' ownership. Within plan areas, multiagency management and monitoring teams should be used where possible to increase efficiency and improve effectiveness.

Fish and Game is working to standardize monitoring across preserve lands and to develop a centrally accessible repository for biological data (known as BIOS), including NCCP monitoring data. Additional funding is needed to continue the development of BIOS. (For more information on BIOS, see Appendix D.)

Monitoring data from local reserve lands should be used to inform collaborative adaptive management for all reserve lands in the region.

The state should evaluate the potential benefits and applicability of developing NCCPs for Santa Barbara, Ventura, and San Bernardino counties.



Fig. 9.3: South Coast Conservation Planning

Natural Community Conservation Planning efforts by local jurisdictions cover more than 3.7 million acres in Southern California.

The Orange County Southern Subregion NCCP

There are a number of NCCPs under development in the South Coast, all of which will require continued staffing and funding to complete. Completion of the Orange County Southern Subregion NCCP is of particular concern because of imminent development threats in the plan area. Continuing attention and negotiation will be required if the plan is to achieve its conservation purpose.

Wildlife agencies, land owners, and local governments should complete Natural Community Conservation Planning for the Orange County Southern Subregion. The plan should address the entire Rancho Mission Viejo Company's property and the Foothill-Trabuco area, which provides important biological connectivity to habitat areas in the Orange County Central Coastal Subregion and the Western Riverside Multi-Species Habitat Conservation Plan.

The Rancho Mission Viejo property is ecologically important because it constitutes a core block of habitat continuous with Camp Pendleton's open space and creates continuity with portions of Cleveland National Forest and other smaller conservation lands belonging to the Audubon Society and Caspers Regional Park. The San Mateo Creek watershed, of which the ranch is a part, supports high-quality coastal sage scrub habitat and is one of few South Coast drainages with a returning steelhead trout population.

Plans for residential and commercial subdivisions on the Rancho Mission Viejo Company's property have been approved by Orange County in advance of the anticipated NCCP plan. Continued conservation planning for the area through the Orange County Southern Subregion NCCP process is important. A comprehensive conservation strategy will most effectively address the effects of development and the mitigation requirements for the **take** of protected species.

b. Wildlife agencies should establish regional goals for species and habitat protection and work with city, county, and state agency land-use planning processes to accomplish those goals.

See Statewide Action a in Chapter 4.

Priorities specific to this region include:

As a complement to NCCP planning, wildlife agencies should work with local governments to develop General Plans and zoning regulations that are compatible with conservation goals. In particular, local land-use plans should direct growth within established communi-

ties and along existing infrastructure and transportation corridors, restrict rural residential subdivision, and support those ranching and agricultural land uses that maintain habitat values and benefit environmental quality.

Land-use planning should be improved to limit the expansion of residential development into wildland and open space areas. Among the benefits of limiting the urban-wildland interface would be a decrease in the incidence of human-caused fires, which would, in turn, reduce the need for fire management practices that disturb ecologically intact habitat lands, prevent unnaturally frequent fire frequencies that promote the expansion of non-native grasses into native vegetation communities, and decrease fire risks to human life and property.

For further discussion of goals and means for improved integration of conservation planning with land-use planning, see the conservation planning section in Chapter 6.

c. Safeguard and build upon Camp Pendleton's contribution to the regional network of conservation lands. Similarly, protect habitats on lands adjacent to the Marine Corps Air Station Miramar.

Management of the base property and any future plans for the base should ensure protection of sensitive species and important habitats on this critical property.

Currently, Camp Pendleton's management of natural resources is guided by an Integrated Natural Resources Management Plan (<http://www.cpp.usmc.mil/base/environmental/inrmp.htm>) as well as a Programmatic Assessment for riparian, estuarine, and beach ecosystems. (See description of Camp Pendleton at the end of this chapter.) State and federal wildlife agencies should continue to work with the base to review management success and to renew and update plans as needed. Completion of the Programmatic Assessment for uplands that is under development is also important. Because uplands constitute the majority of base property, this planning effort affects a larger portion of the base than previous single-species or aquatic habitat plans.

Regional conservation organizations and wildlife agencies should work with Camp Pendleton to protect important habitats, wildlife corridors, and open space areas adjacent to the base property. This should be done in a manner that protects the mission of the base, reduces conflicts between the base's mission and sensitive species, and enhances the base's contribution to the regional network of conservation lands.

Camp Pendleton has access to Department of Defense funds to invest in conservation activities in areas surrounding the base. In order to apply these funds to land acquisition, the base needs suitable partners to serve as landholders; such partners could include non-

governmental conservation organizations or public agencies, such as counties establishing their NCCP reserve networks.

Although Camp Pendleton's primary mission is military training, natural resources management is also an important goal. Currently, Camp Pendleton's management of natural resources is guided by an Integrated Natural Resources Management Plan (US DOD 2001) as well as a Programmatic Assessment for riparian, estuarine, and beach ecosystems. The first is the Santa Margarita River corridor, which connects Camp Pendleton to protected lands abutting Cleveland National Forest and a series of inland mountain ranges. Camp Pendleton is collaborating with the South Coast Missing Linkages Project and the South Coast Conservation Forum (a consortium of regional conservation interests that includes San Diego State University Field Stations Programs, The Nature Conservancy, Trust for Public Land, and Riverside and San Diego counties) to identify opportunities to protect this area. See further discussion of the Santa Ana-Palomar linkage in action item d, below.

Also important are Rancho Mission Viejo Company's currently undeveloped ranch lands adjacent to the base's northern boundary. Opportunities to protect this area include continued conservation planning for the area through the Orange County Southern Subregion NCCP process, purchase of lands by conservation buyers, and collaboration with the U.S. Army Corps of Engineers Special Area Management Plan to protect and restore the San Juan Creek and San Mateo Creek watersheds. Marine Corps Air Station Miramar and adjacent lands provide habitat for wildlife species at risk, have sensitive plant species and vernal pools, and serve as wildlife corridors for the region. Conserving adjacent lands to the base will benefit biodiversity in the region. (Additional information can be found at [http:// www.miramar.usmc.mil/WebPages/Environmental/IntegratedNaturalResources.htm](http://www.miramar.usmc.mil/WebPages/Environmental/IntegratedNaturalResources.htm).)

d. To address regional habitat fragmentation, federal, state, and local agencies, along with nongovernmental conservation organizations, should support the protection of the priority wildlands linkages identified by the South Coast Missing Linkages project.

See Statewide Action d in Chapter 4.

Priorities specific to this region include:

The South Coast Missing Linkages project aims to protect the remaining corridors between regional wildlands and natural areas that allow them to function as one interconnected ecological system. Based on the size of the connected habitat areas, degree of threat, and irreplaceability, 15 linkage areas have been designated as high-priority conserva-



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tion issues for the region. Given the patterns of urbanization and protected lands in the region, these are primarily linkages between mountain ranges having significant public ownership (e.g., National Forest lands).

Creating and maintaining these linkages will require a combination of land protection through acquisitions and easements, focused habitat management, and construction of underpasses and overpasses to enable wildlife to get across major roadways. Public agencies and nongovernmental conservation organizations should work to support and build upon existing protection activities in these linkages.

The Santa Ana–Palomar linkage and the Tehachapi linkage are two priority linkages where protection activities are under way. The Santa Ana–Palomar linkage extends from the Camp Pendleton Marine Corps Base and Fallbrook Naval Weapons Station in the west to the Cleveland National Forest Palomar Range District in the east. This linkage is made up of the last remaining natural habitats that connect the Santa Ana Mountains and the coastal lowland areas of Camp Pendleton to an inland chain of largely protected mountain ranges (the Palomar, San Diego, San Jacinto, and San Bernardino mountains).

The Tehachapi linkage serves to connect the natural lands of the South Coast with habitats in other regions. It is the sole remaining wildland connection between two major mountain

systems, the Sierra Nevada and the Sierra Madre, and links the Sequoia and Los Padres national forests. The linkage area lies at the confluence of four regions, the South Coast, Sierra Nevada, Central Valley, and Mojave Desert, each with its own distinct terrain, flora, and climate patterns. The convergence of these biogeographic elements in one contiguous area underlies the Tehachapi linkage's remarkable biodiversity (CBI 2004b, Penrod et al. 2003). The area supports 23 different vegetation communities, including low-elevation grasslands and oak woodlands that are underprotected in the region. The area also provides designated critical habitat for the endangered California condor and potential habitat for as many as 20 state and federally listed species and more than 60 other rare and endemic species (CBI 2004b).

e. Federal, state, and local agencies, along with nongovernmental conservation organizations, should protect and restore the best remaining examples of coastal wetlands that provide important wildlife habitat.

Wildlife agencies and conservation organizations should continue to utilize and build on the work of the Southern California Wetlands Recovery Program to develop a regional prioritization plan for the protection and restoration of Southern California's wetlands. The Wetlands Recovery Program is a collaborative effort of public agencies, including the California Coastal Conservancy, county task forces, Fish and Game, the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and others. The program has worked to identify priority sites for acquisition and restoration efforts, to develop plans for priority sites, and to identify opportunities to develop partnerships and to pool funds to undertake these projects. (More information can be found at <http://www.scwrp.org>.)

Important conservation actions identified in the Southern California Wetlands Recovery Program Regional Strategy include:

- Acquiring or negotiating conservation easements on remaining coastal wetlands that are partially or entirely in private ownership. These include Ormond Beach/Oxnard Plain in Ventura County, Los Cerritos Wetlands in Orange and Los Angeles counties, and Huntington Beach/Santa Ana River mouth in Orange County.
- Completing coastal wetland restoration projects that are currently under way to protect remaining coastal wetland species. Needed restoration activities include removing excess sediment resulting from development and construction; rerouting of excess freshwater runoff inputs; excavating channels to restore tidal exchange; controlling invasive species; improving habitats affected by highway and railway crossings; and removing derelict oil wells and infrastructure. Restoration along inflowing waterways is also needed to address sediment,

nutrient, and contaminant inputs. The most significant coastal wetland restoration projects being planned or implemented include the south arm of the Tijuana Estuary in San Diego County; coastal lagoons in northern San Diego County; Upper Newport Bay in Orange County; Huntington Beach Wetlands in Orange County; Bolsa Chica Wetlands in Orange County; Ballona Wetlands in Los Angeles County; Ormond Beach/Oxnard Plain in Ventura County; and Goleta Slough in Santa Barbara County.

f. Public agencies and nongovernmental conservation organizations should invest in efforts to protect and restore the best remaining regional examples of ecologically intact river systems.

Benefits to water quality and sensitive aquatic species can be achieved by preserving natural functioning in aquatic systems. Riparian vegetation, wetlands, and large natural land areas within a watershed filter inflow and reduce nutrient, bacteria, sediment, and other pollutant levels. Native species are often adapted to natural seasonal flow regimes. The remaining riparian habitat of the South Coast Region also serves as important stopover habitat for migratory birds, as well as essential breeding habitat for listed species such as the southwestern willow flycatcher and the least Bell's vireo.

Efforts to maintain relatively intact systems are more cost effective than subsequent measures to mitigate environmental damage, treat degraded water quality, or restore dramatically altered systems.

Restoration and protection efforts should be focused on the region's most ecologically intact drainages, which include those that provide existing or potential habitat for southern steelhead trout; those that remain largely unchannelized; those that support riparian vegetation communities; and those with functioning floodplains (or where construction and development in riparian areas is limited enough to reestablish functioning floodplains).

Because of the high level of urbanization in the South Coast Region, even the most intact systems will typically need some restoration work. Important restoration actions include enhancing riparian habitat and vegetation; relocating or removing confining levees to allow river-channel meandering and reconnection of rivers with their floodplains; removing dams, diversions, or other obstacles to sediment transport and fish passage; and providing more water for instream flows.

To protect water quality and aquatic habitats, wildlife agencies, local governments, and conservation organizations should work to protect land and limit development within targeted priority watersheds through acquisitions, easements, or zoning regulations. Recognizing

these benefits and applying water quality protection and flood-control funds to land protection mark an innovative use of state conservation bond funds.

Regionally, important opportunities to protect and restore largely intact drainages include the Santa Clara, Ventura, Santa Margarita, San Jacinto, and San Luis Rey rivers and San Mateo Creek (California Legacy Project 2003, CCC 2001, Morrison 2004 pers. comm.).

g. Federal, state, and local agencies should provide greater resources and coordinate efforts to eradicate or control existing occurrences of invasive species and to prevent new introductions.

See Statewide Action f in Chapter 4.

Priorities specific to this region include:

Agencies should increase efforts to control invasive aquatic animals, particularly bullfrog, African clawed frog, and introduced crayfish species, through a combination of eradication and trapping efforts and improved water-management practices. Drainage systems for urban runoff water should be altered where necessary to avoid conditions that favor bullfrogs.

Agencies should design and implement measures to prevent infrastructure development and utility maintenance projects from introducing non-native species. Ensure that public works projects, such as post-fire reseeded projects to prevent erosion, are carried out with native species.

Agencies and conservation organizations should increase public education about invasive species, including the potential threats presented by the release of aquarium fish or plant species.

h. Federal, state, and local public agencies should sufficiently protect sensitive species and important wildlife habitats on their lands and should be adequately funded and staffed to do so.

Across the South Coast, public lands total nearly 2.4 million acres, or nearly 34 percent of the region. The U.S. Forest Service is the region's largest public land manager; together, the Cleveland, San Bernardino, and Angeles national forests encompass 1.7 million acres. Other public land agencies with substantial land management responsibilities include BLM, with more than 150,000 acres; Camp Pendleton Marine Base and Air Station, with 125,000 acres; Marine Corps Air Station Miramar, with 23,000 acres; California Department of Parks and Recreation, with 114,000 acres; Fish and Game, with more than 60,000 acres; the National Park Service, with more than 22,000 acres; the U.S. Fish and Wildlife Service, with 11,000 acres; and city and county parks that total 44,000 acres, including many coastal wetland reserves.

Because of the high level of urbanization in the region, many of the region's public lands are vulnerable to the negative ecological effects of nearby development, including the spread of invasive species, air and water pollution, and altered fire regimes. Dumping, trespass, and illegal off-highway vehicle use can also present major challenges. As a result of these pressures, public agencies need adequate staff and funding resources for management.

Public agencies should adopt management policies that safeguard natural resources and wildlife habitat, even as they manage for multiple uses or for mandates that emphasize other objectives.

- Public agencies should monitor all public and recreational uses, and, through adaptive management, determine the appropriate uses for a specific area. Where agencies determine that use restrictions are needed to protect sensitive species and habitats, those restrictions should be adequately enforced.
- Streams and watersheds on public lands should be protected and restored. In light of the stresses posed by drought and human water use, public agencies should work to provide adequate instream flows for aquatic species by reducing or eliminating water diversions on public lands.
- Infrastructure and resource-extraction projects should be designed and sited to avoid harmful effects on sensitive species and habitats and to preserve connectivity between existing natural lands and habitat areas.
- Based on the best available science and site-specific conditions, fire management policies and practices should be designed to restore the ecological integrity of the region's natural communities.
- Public agencies, along with nongovernmental conservation organizations, should work to protect lands that enhance the ecological and habitat values of existing public lands. Means for protection may include employing conservation easements and management agreements with landowners and acquiring public land from willing sellers. Priority areas for protection include private inholdings within the national forests, adjacent natural areas that buffer against the adverse effects of urbanization, and areas where development pressures threaten connectivity between public lands.

i. Federal and state agencies and nongovernmental partners should collaborate to institute appropriate fire management policies and practices to restore the ecological integrity of the region's ecosystems while minimizing loss of property and life.

- Continued research is needed to better understand the fire regimes required to maintain the health of different vegetation communities (shrub, chaparral, grasslands, and forests) and to understand the most ecologically appropriate management for lands that have experienced large-scale wildfires.

- State and federal land managers and wildlife biologists should work cooperatively to design prescribed-fire treatments and other management practices that will mimic the ecological role of wildfire in creating habitat mosaics.
- Fuel control treatments and fire suppression efforts should be focused on the interface between residential areas and wildlands.

j. The state should coordinate the development of a model ordinance and building codes for new or expanding communities in fire-adapted landscapes to make those communities more fire compatible and reduce the state's liability for fire suppression.

Counties need to consider adopting development restrictions requiring planning and accommodation for wildfire consistent with the local historical fire regime, and such measures should be incorporated into the public-safety elements of the county General Plans. In addition, specific ordinances should be adopted:

- The model ordinances should address the design of new development to ensure new communities are safer and compatible with natural forest fires.
- The model ordinances should address maintenance of existing residential and commercial areas to ensure firebreaks are maintained to improve compatibility with forest fires.
- Model building codes should specify that all new construction employ materials and design features to make them more fire resistant.
- The state should encourage adoption of the model fire ordinances and building codes by cities and counties in forested areas.

k. State and federal wildlife agencies, the U.S. Forest Service, state and county parks, BLM, and nongovernmental partners should collaborate to develop a comprehensive Southern California Outdoor Recreation Program to provide recreational opportunities and access that do not conflict with wildlife habitat needs.

With more than 18 million people living within driving distance of many of the region's public lands, the demand for outdoor recreation opportunities and the resulting pressures on natural resources continue to increase.

A comprehensive, regionwide program is needed to evaluate which public land areas are most appropriate for different forms of recreation, to develop recreational opportunities in these areas, and to direct inappropriate recreational uses away from biologically sensitive areas and important wildlife habitats. The program should determine where funding for recreational facilities and access should be directed, where user fees should be instituted, and

where public safety and law enforcement staff are most needed. Additionally, education programs should be expanded to provide information about which public land areas are open to which uses, about how to minimize the impacts of recreation, and about the unique natural resources of the South Coast.

Southern California Natural Community Conservation Planning

The California Natural Community Conservation Planning (NCCP) program, initiated in 1991, has been a primary tool to address habitat loss and limit fragmentation in the region. (See additional discussion of NCCPs in Chapter 6.) The program brings together state and federal wildlife agencies, local governments, developers, landowners, and other stakeholders to collaborate on regional conservation plans. The plans designate where and how much development can occur and identify areas that are important to preserve as habitat for protected or sensitive species. The program's goal is to create regional reserve networks of relatively large, connected habitat blocks rather than protecting species on a species-by-species, project-by-project basis. Once a regional plan is approved by the U.S. Fish and Wildlife Service and the California Department of Fish and Game—including guidelines for permissible development and for the establishment of a permanent reserve system—local jurisdictions receive federal and state permits for the take of species covered in the plan.

The initial focus of the NCCP effort was the coastal sage scrub ecosystem. The decline of coastal sage scrub and the California gnatcatcher illustrates the toll that Southern California's population growth has taken on regional wildlife. As of the early 1990s, about 400,000 acres of sage scrub remained, representing no more than 18 percent of its historic extent (Jasny et al. 1997, Pollak 2001a). Scattered in patches across five counties, the remaining sage scrub resembled islands in a sea of development and was often degraded by grazing, weed invasion, fires, recreation, and other human impacts (Pollak 2001a).

The gnatcatcher exemplified the issues that brought a sense of crisis to conservation issues in Southern California. Once considered common, the sage-scrub-dependent California gnatcatcher was steadily declining. The U.S. Fish and Wildlife Service estimated in 1993 that fewer than 2,500 gnatcatcher pairs remained (Jasny et al. 1997), and the species was proposed for listing under the Endangered Species Act. Local development interests believed that federal protection of the bird could have halted development on large areas of highly valued coastal land. The proposed federal and California Endangered Species Act listings of the gnatcatcher seemed to place economic interests and wildlife conservation on a collision course.

Under the leadership of the state, and with the support of the Department of the Interior, California's NCCP program was developed to help avert conflict. In 1993, the gnatcatcher was federally listed as threatened. Accompanying the listing were interim rules that tied into the NCCP process, allowing the limited take of gnatcatchers until an NCCP plan is approved and permitted. These rules authorized the loss of up to 5 percent of the remaining coastal scrub habitat, so long as it resulted from activities conducted in accordance with the NCCP guidelines and wouldn't preclude design and creation of an adequate reserve system. The loss of coastal sage scrub habitat also required appropriate mitigation (USFWS 1993b).

Once adopted, final NCCPs will supersede the interim take rules, and federal and state permits for the take of species covered in the plan will be granted along with the plan's final approval.

The Southern California NCCP planning area includes portions of Los Angeles, Riverside, San Diego, Orange and San Bernardino counties. There are now nine NCCPs completed (including sub-area plans), covering an area of over 2 million acres, with 14 additional plans under way in Southern California, covering an additional 1.7 million acres. Reserve systems include existing public lands as well as private lands either purchased or dedicated through a land-use process.

The current status of the major regional plans is summarized in the table on the following page.

Table 9.3: Regional Planning Status

Local Jurisdiction Planning Effort	Approval Status	Coverage
Orange County Central-Coastal NCCP	Approved 1996	Planning area of 131,000 acres in Orange County; 37,000-acre reserve system
Orange County Southern Subregion NCCP	Planning	Planning area of 91,000 acres (33,000 of which are currently developed); reserve system size yet to be determined
Palos Verdes Peninsula NCCP (in Los Angeles County)	Near completion	Planning area of 8,559 acres on Palos Verdes Peninsula; proposed reserve system size of 1,500 acres
San Diego County MSCP (includes sub-area plans for incorporated cities, some of which are complete; others are pending and close to approval)	Approved 1997	Planning area of 582,000 acres of southwest San Diego County; includes unincorporated areas of the county and the incorporated areas of San Diego, Poway, Santee, La Mesa, Chula Vista, and El Cajon; 170,000-acre reserve system
San Diego County MHCP (includes sub-area plans for incorporated cities, one of which has been approved)	Approved 2003	Planning area of 118,000 acres in northern coastal San Diego County; includes the incorporated areas of Carlsbad, Encinitas, Escondido, Oceanside, San Marcos, Solana Beach, and Vista; 20,000-acre reserve system
San Diego North County MSCP Sub-area	Planning	Planning area of 315,000 acres in northwestern San Diego County to the east of MHCP area
San Diego East County MSCP	Planning in initial stages	Planning area of over 1 million acres in far eastern San Diego County (an area with lower development pressure)
Western San Bernardino County NCCP	Stalled; inactive	Planning area of 320,000 acres in western San Bernardino County
Western Riverside County MSHCP	Approved 2004	Planning area of 1.2 million acres; 500,000 acre reserve system

Camp Pendleton

The Camp Pendleton Marine Corps Base and Marine Corps Air Station (collectively known as Camp Pendleton) is located between two major metropolitan areas, with Los Angeles and Orange County to the north and San Diego to the south. The largely undeveloped 125,000-acre installation stands out from surrounding areas of coastal development. As on other military installations across the country, large open space areas have been preserved for training exercises. Because rapid urbanization has spared few natural areas on the South Coast, Camp Pendleton has inadvertently become a critical refuge for a number of sensitive and protected species.

Camp Pendleton is one of only two places on the South Coast where coast-to-mountains habitat continuity remains. The base hosts a variety of community types, including oak woodlands, chaparral, grasslands, coastal dunes, riparian communities, and coastal lagoons. Particularly significant habitats are vernal pools, the large extent of undeveloped shoreline (17 miles), and one of the largest remaining contiguous areas of coastal sage scrub. This habitat diversity results in a rich flora and fauna. More than 800 plant species, hundreds of invertebrate, 300 bird, 50 mammalian, 30 reptilian, 10 amphibian, and 60 fish species have been identified on Camp Pendleton. Eighteen federally protected species make use of habitats on the base, including California least tern, coastal California gnatcatcher, southwestern willow flycatcher, least Bell's vireo, light-footed clapper rail, Western snowy plover, Pacific pocket mouse, Stephens' kangaroo rat, southern steelhead trout, tidewater goby, arroyo toad, Riverside fairy shrimp, and San Diego fairy shrimp.

Camp Pendleton's management of natural resources is guided by an Integrated Natural Resources Management Plan and a Programmatic Assessment for riparian, estuarine, and beach ecosystems (a Programmatic Assessment for upland areas, including vernal pools, is forthcoming), which were developed in cooperation with the U.S. Fish and Wildlife Service and Fish and Game (MCB/MCAS Camp Pendleton, 2001). The plans outline management activities to protect important species and habitats on the base. Compliance with the plans allows the base to receive limited take permits for covered species. Measures in the Integrated Natural Resources Management Plan include introduced predator and exotic species control, notably removal of arundo in the Santa Margarita River riparian area; yearly surveys for California gnatcatcher and least Bell's vireo; control of brown-headed cowbirds; and restrictions on beach use during Western snowy plover and least tern nesting season. The Programmatic Assessments focus on protection of ecosystems, rather than on management for individual species; for instance, the assessments identify areas where training operations could harm important natural communities and make recommendations for appropriate training locations.

Camp Pendleton officials and planners are also concerned about patterns of residential and commercial growth surrounding the base. Urban encroachment surrounding the base could adversely affect the military mission (because of noise ordinances and other restrictions near residential areas adjacent to the base and increased flooding risks associated with runoff from urbanizing watersheds [Steinitz 1996]). Additionally, as important habitat areas are lost regionally, greater numbers of species depend largely on Camp Pendleton for habitat, placing ever-greater management responsibilities and restrictions on the base. Camp Pendleton officials and planners therefore have an interest in protecting regional habitats and are involved with conservation planning efforts for nonmilitary lands surrounding the base.

